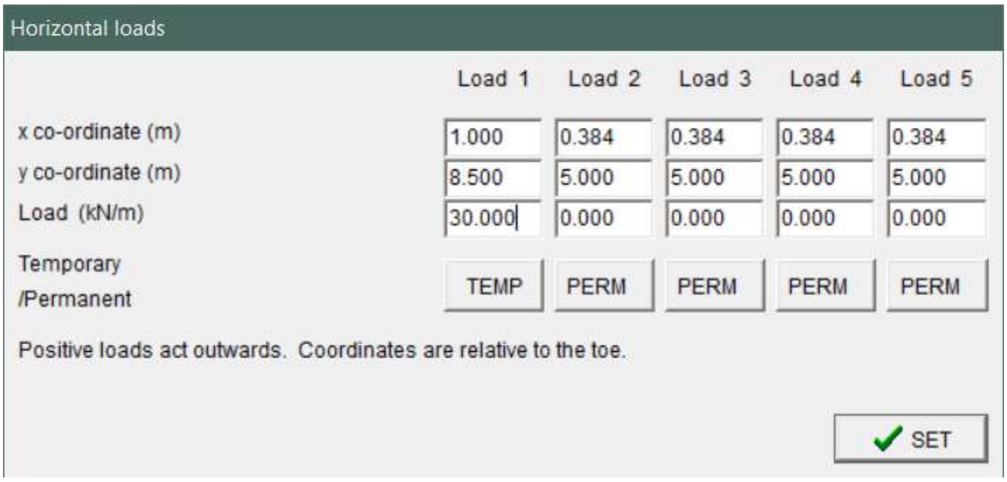
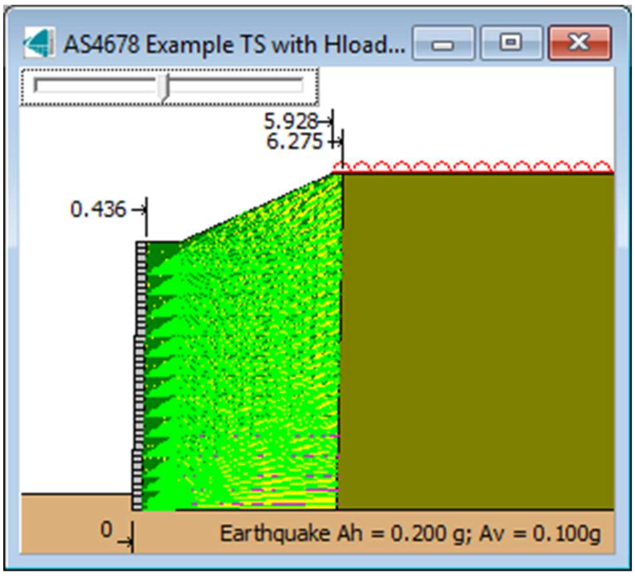
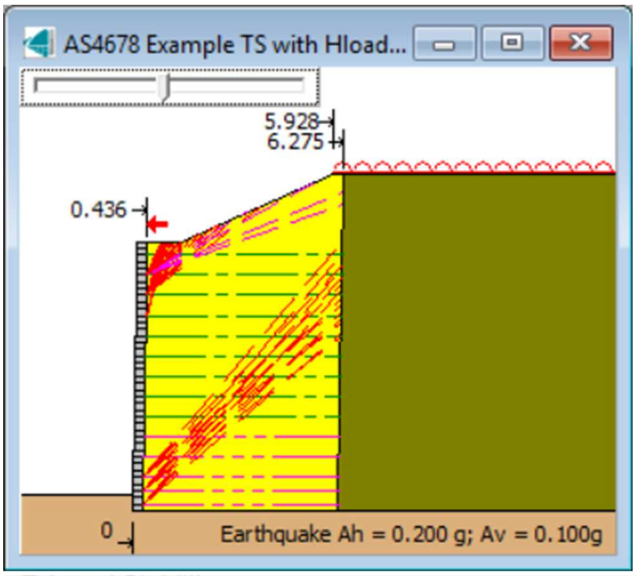
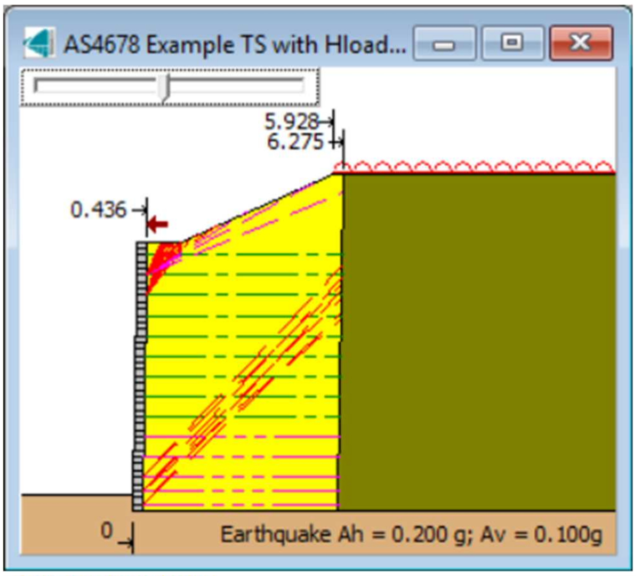
Tensar software

FAQ's (frequently asked questions): Item 20

Program	TensarSoil (and TensarSlope)
Topic	Definition of horizontal loads in TensarSoil (and TensarSlope) and the effect of setting “Temporary” or “Permanent”
Question	TensarSoil Version 2.09.04 (and TensarSlope Version 1.16.03) has the facility to set horizontal loads to TEMP or PERM (temporary or permanent) using a toggle below the load value (see input window below). What is the difference between and effect of these two settings? 
Discussion	The assignment of TEMP or PERM to the horizontal load (H load) will have the same result as with normal vertical surcharges. If TEMP is set, then the H load will only be included when it has a negative impact on stability, ie. it is unfavourable and contributes to the destabilising forces. H loads set outwards will always be destabilising. If set to PERM, then H loads will be included in all calculations. However, in the case of limit-state design methods, this setting will also determine the partial load factor to be used in each load combination. There follows an example using the AS4678 2-part wedge limit-state design method. The basic wall arrangement is shown below, taken from a worked example, and the design is very efficient, so that critical wedges are just satisfactory in the case that there is no H load set:  An H load of 30 kN/m is added to the section above, using the parameters in the first image. Partial load factors of relevance in AS4678 are as follows: • Static load case: unfavourable dead loads γ_D = 1.25, unfavourable live loads γ_Q = 1.5, and • Seismic load case: unfavourable dead loads γ_D = 1.25, unfavourable live loads γ_Q = 0.5 (these load factors are for the static components of load in the seismic design case). The effects of these partial load factors and the PERM or TEMP settings on the resulting stability are examined below. In AS4678 this is given by R*/S*, the ratio of factored resistance to factored driving force (same as CDR or capacity demand ratio in AASHTO/LRFD).

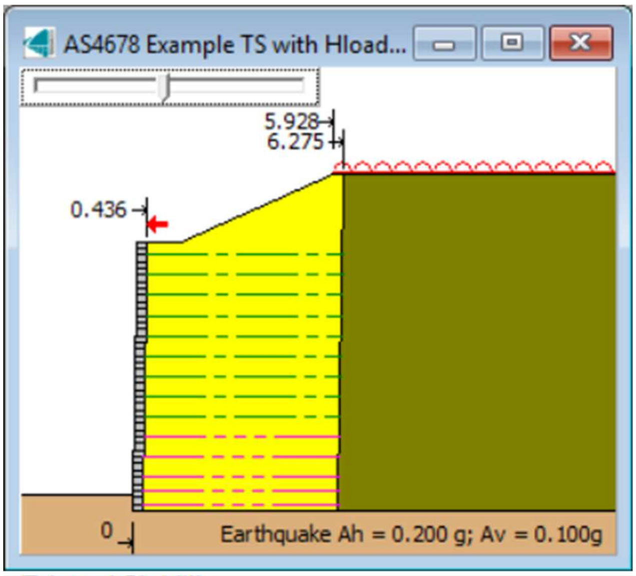
<table>
<tr>
<td>Static design case</td>
<td>This shows static internal and external stability results for the H load set to TEMP


External Stability
Sliding R*/S* = 1.803 OK
Bearing R*/S* = 3.449, A_OT OK
Eccentricity =
0.925 m, < B/6 =1.017, B OK
This shows static internal and external stability results for the H load set to PERM


External Stability
Sliding R*/S* = 1.844 OK
Bearing R*/S* = 3.449, A_OT OK
Eccentricity =
0.857 m, < B/6 =1.017, B OK
Discussion:
The internal stability check for TEMP shows rather more red wedges indicating R*/S* below the target. This occurs because the partial load factor on live loads (γ_Q = 1.5) is greater that the partial load factor on dead loads (γ_D = 1.25).
The external stability check shows the same pattern for sliding on the base and eccentricity, for the same reasons. However, the bearing check is the same in both cases (R*/S* = 3.449). The reason for this is that the H load is only included in the calculation of eccentricity in the bearing check, and in this case only unfactored loads are used to calculate this value which is required to determine the effective width for the bearing capacity calculation. In the subsequent calculation of R*/S* for bearing, the loads are factored, but these are only the vertical loads, and the H load has no vertical component, of course.</td>
</tr>
</table>

Seismic design case vertical component down

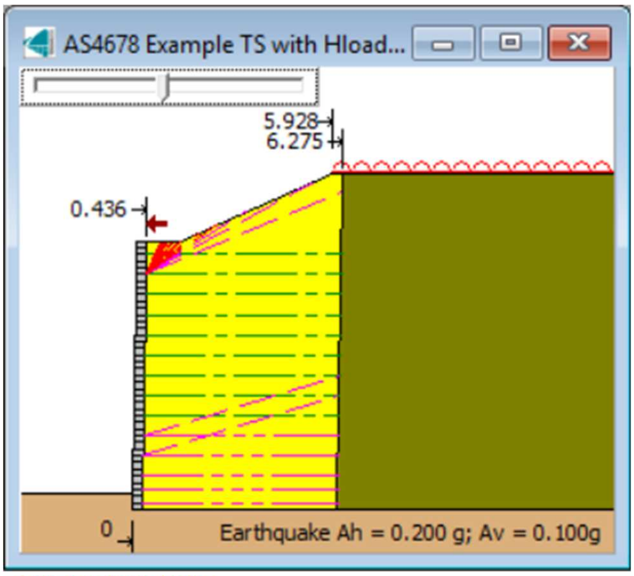
This shows seismic (K_v down) internal and external stability results for the H load set to **TEMP**



External Stability

Sliding not checked for Kv down	-
Bearing R*/S* = 1.733, A_OT	OK
Eccentricity =	
1.070 m, < B/4 =1.525, B	OK

This shows seismic (K_v down) internal and external stability results for the H load set to **PERM**



External Stability

Sliding not checked for Kv down	-
Bearing R*/S* = 1.733, A_OT	OK
Eccentricity =	
1.266 m, < B/4 =1.525, B	OK

Discussion:

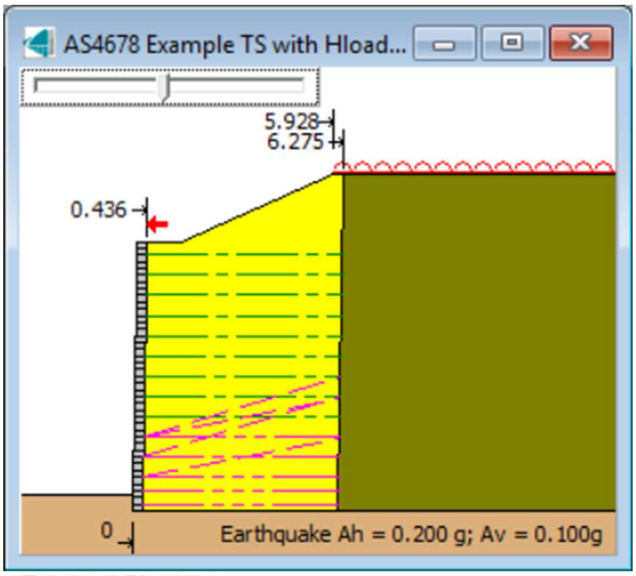
The internal stability check for TEMP shows no red wedges because the partial load factor on the H load is only 0.5 for live loads (γ_Q = 0.5), whereas the PERM case shows some red wedges and lower angle pink wedges because the partial load factor on the H load is 1.25 for the static component of dead loads (γ_D = 1.25). However, the PERM case appears less critical than the static PERM case, because of lower conservatism for the seismic design case.

NB: red wedges indicate that Load Combination "A" is critical (steeper wedges), whereas pink wedges indicate that Load Combination "B" is critical (lower angle wedges).

External stability does not include sliding on the base for seismic with K_v down, because seismic with K_v up will always be more critical for the sliding check. The bearing check is the same in both cases (R*/S* = 1.733), for the same reasons as discussed in the static check, but with a much lower value due to other factors affecting the seismic case. The eccentricity is greater for PERM for the same reasons as discussed for the internal stability check.

Seismic design case vertical component up

This shows seismic (K_v up) internal and external stability results for the H load set to **TEMP**



External Stability

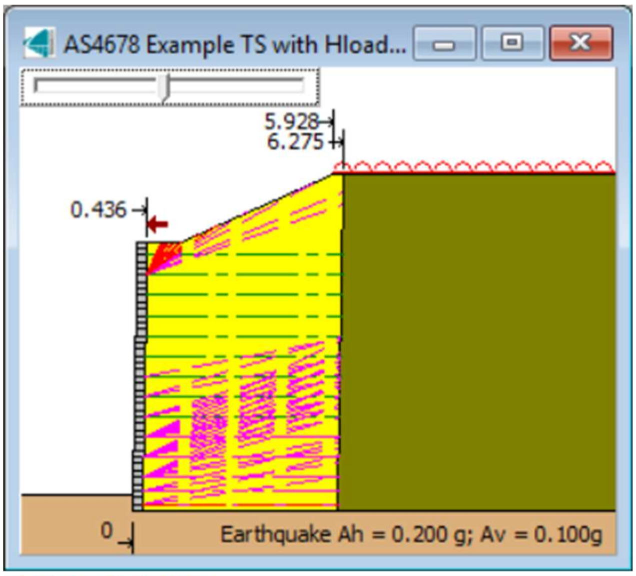
Sliding R*/S* = 1.526 OK

Bearing R*/S* = 1.815, A_OT OK

Eccentricity =

1.041 m, < B/4 =1.525, B OK

This shows seismic (K_v up) internal and external stability results for the H load set to **PERM**



External Stability

Sliding R*/S* = 1.442 OK

Bearing R*/S* = 1.815, A_OT OK

Eccentricity =

1.252 m, < B/4 =1.525, B OK

Discussion:

The internal stability check for TEMP shows some low angle pink wedges whereas the PERM case shows many more low angle pink wedges. This is again due to the partial load factor on TEMP loads being only 0.5 (γ_Q = 0.5), compared to 1.25 for the static components of dead loads (γ_D = 1.25). The low angle wedges are more critical for K_v up, because the lower vertical force is reducing the stabilising frictional force on the base of these wedges.

For external sliding and eccentricity, PERM is more critical for the same reasons as for the low angle pink wedges, and again the bearing check is the same in both cases (R*/S* = 1.815), for the same reasons as discussed in the static check. R*/S* for bearing is higher for K_v up because the total downward forces applied in the bearing capacity check are lower.

FAQ20

Issue update: 19th November 2018